PATENT SPECIFICATION (11) 1 465 311

1 465 311

(21) Application No. 9421/74 (22) Filed 1 March 1974 (19)

(31) Convention Application No. 7 31,965 (32) Filed 20 March 1973 in

(33) South Africa (ZA)

(44) Complete Specification published 23 Feb. 1977

(51) INT. CL.² B04B 5/00 11/04

(52) Index at acceptance

B2P 10B3 10C3A 10C3B1A 10C3D 10C3F 10D 2 8B 8C

(54) SEPARATING AND CLASSIFYING MEANS

(71) We, CLASICON (PROPRIETARY) LIMITED, a Company incorporated under the laws of South Africa, of care of Viljoen, Louw, Bartel and Partners, Trustfontein Building, 151 St. Andrews Street, Bloemfontein, Orange Free State Province, Republic of South Africa, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a means for separating physically separable constituents from a fluid mixture thereof with a carrier fluid. The invention further relates to a means for also classifying the constituents into fractions. The constituents may be in any of the three phases, i.e. gas, liquid or solid. The mixture may thus be a liquid-gas, liquid-solid, gas-solid, liquid-liquid or any other similar mixture that is fluid.

According to the invention there is provided an apparatus for separating physically separable constituents from a fluid mixture thereof with a carrier fluid, including

a tubular container mounted for rotation about a rotational axis and having an inlet opening at one axial end and an outlet opening the the other axial end;

a radially outwardly extending settling compartment fast with the tubular side wall of the container about an entrance aperture provided in the wall, the settling compartment converging from its radial inner entrance end to a closable discharge orifice, at its radial outer end, the radial depth of the compartment being greater than the axial width of its entrance aperture;

a valve for closing the orifice;

feed means for feeding the mixture into the container through its inlet opening; and

flow means for causing the mixture to flow along the tubular side wall of the container towards its outlet end and towards and past the entrance to the compartment.

Sensors may be provided for sensing the volume of constituents settled out in some or all of the compartments, the valves of those compartments being responsive to the respective sensors to automatically open the discharge orifices of the respective compartments when the volume of constituents settled out in the compartment exceeds a predetermined value. Alternatively, the apparatus may include timing means, some or all of the valves being responsive to the timing means to automatically open the associated discharge orifices for a predetermined period of time at predetermined intervals.

In order to collect the settled constituents that have been discharged from the compartment through its discharge orifice, a stationary casing may be disposed around the container, the casing having means for directing the discharged constituents towards a collector.

The apparatus may be adapted to classify the separated constituents into fractions. Thus, the apparatus may include a plurality of axially spaced apart radially outwardly extending settling compartments, fast with the tubular side wall of the container about spaced entrance apertures provided therein, each settling compartment converging from its radial inner entrance end to a closable discharge orifice at its radial outer end, the radial depth of each compartment being greater than the axial width of its entrance aperture. Each compartment has a valve to close its orifice, and each valve may be responsive to a sensor or to timing means.

In a preferred embodiment, the compartments may be arranged in axially spaced banks, each bank of compartments comprising a plurality of circumferentially spaced compartments.

With such apparatus adapted to classify the separated constituents, the stationary casing may be provided with means for directing the various fractions discharged from the relevant compartments towards collecting means for separately collecting the respective fractions.

In order to cause the mixture to flow along the tubular side wall of the container from its inlet end to its outlet end, the con-

tainer may be frusto-conical having its inlet opening at its narrow end and its outlet opening at its wider end. By this means, the centrifugal force which the mixture in the container experiences due to rotation of the container, causes it to flow along the tubular side wall thereof. Further, the container may be mounted for rotation about a vertical axis, with its narrow inlet end at the bottom.

The container may also have internal fins for agitating the mixture therein to cause the mixture to rotate along the container.

The invention will now be described by way of an example, with reference to the accompanying drawings, in which:

Figure 1 shows a schematic side elevation; and

Figure 2 shows a view along the line II—II of Figure 1, of a separating and classifying apparatus in accordance with the invention.

The apparatus is referred to generally by reference numeral 10. It comprises an open ended frusto-conical container 12 adapted to be driven for rotation about a vertical axis 13. The container 12 has an inlet end 14 at its bottom narrow end and a tubular side wall 16 diverging from said inlet end to the top open end of the container 12. A plurality of settling compartments 18 are provided at different elevations in longitudinally spaced banks 30, with a section of the wall 16 between the successive banks 30 of compartments 18. Each compartment 18 is also frusto-conical in shape and converges radially outwardly from its radial inner entrance end to a closable discharge orifice 31 at its radial outer end. Each compartment 18 is fast with the wall 16 of the container 12, about an entrance aperture 48 provided in the wall. Each compartment 18 has a radial depth greater than the axial width of its entrance aperture 48.

A shaft 20 is rotatably mounted on a frame 22 supported by suitable bearings 17, and is provided with a belt-driven pulley 24 connected to a drive motor 26. The container 12 is connected to the drive shaft 20 by means of radial arms 28. Radially extending fins 29 are also fast with the shaft 20 and the wall 16 of the container 12.

Each compartment 18 has a sensor 33 and a valve 32 for closing its orifice 31. The sensor 33 are operatively linked with the valves 32. Alternatively, the valves 32 may be operated periodically by suitable timing means.

A stationary outer casing 34 is provided which surrounds the container 12. The outer casing 34 has circumferentially extending, longitudinally spaced baffles 36 which act to direct the settled constituents that are discharged from the respective compartments 18 towards separate collecting means (not shown). A stationary reservoir 15 surrounds the shaft 20 and the inlet end 14 of the container 12, a seal 37 being provided.

An internal constraining wall 50 may also be provided as shown in dotted lines in the drawings, to restrict the radial thickness of mixture flowing along the wall 16.

In use, a mixture comprising, for example, sand particles suspended in water is provided in the reservoir 15 and is fed into the inlet end 14 of the container. Due to the agitation of the fins 29, a centrifugal force is imparted to the feed and it is displaced upwardly in the direction of arrows 38 upon rotation of the container, the mixture flowing along the wall 16 of the container 12 towards and past the entrances of the compartments 18. The compartments 18 are filled and heavier or larger sized fractions of the sand are settled in the lower settling compartments and lighter or smaller fractions are settled in the upper settling compartments from the mixture, until substantially solids-free water overflows at 40. When a predetermined volume of sand has settled in the compartments, this is detected by the sensors 33, and the valves 32 are opened. Due to the centrifugal force the different fractions of sand are discharged at different elevations into the stationary casing 34 and are directed by its baffle plates 36 to be collected by suitable collecting means (not shown).

With other mixtures, the constituents may be classified into the various fractions, in accordance with the specific gravities or densities of the constituents.

By varying the width of the entrance apertures 48 or the radial depths of the compartments 18 (with the radial depths of the compartments being greater than the axial width of the entrance apertures), the spacing of the banks, the number of banks or the rotational speed of the container, the number and quality of the fractions may be varied.

WHAT WE CLAIM IS:—

1. An apparatus for separating physically separable constituents from a fluid mixture thereof with a carrier fluid, including

a tubular container mounted for rotation about a rotational axis and having an inlet opening at one axial end and an outlet opening the the other axial end;

a radially outwardly extending settling compartment fast with the tubular side wall of the container about an entrance aperture provided in the wall, the settling compartment converging from its radial inner entrance end to a closable discharge orifice, at its radial outer end, the radial

depth of the compartment being greater than the axial width of its entrance aperture;

a valve for closing the orifice;

feed means for feeding the mixture into the container through its inlet opening; and

flow means for causing the mixture to flow along the tubular side wall of the container towards its outlet end and towards and past the entrance to the compartment.

2. A separating apparatus as claimed in Claim 1, which includes a sensor for sensing the volume of constituents settled out in the compartment, the valve being responsive to the sensor to automatically open the discharge orifice of the compartment when the volume of constituents settled out in the compartment exceeds a predetermined value.

3. A separating apparatus as claimed in Claim 1, which includes a timing means, the valve being responsive to the timing means to automatically open the discharge orifice for a predetermined period of time at predetermined intervals.

4. A separating apparatus as claimed in any one of the preceding claims, which includes a stationary casing disposed around the container, said casing having means for directing settled constituents, discharged from the compartment through its discharge orifice, towards a collector.

5. An apparatus for separating physically separable constituents from a fluid mixture thereof with a carrier fluid and for classifying the separated constituents into fractions, including

a tubular container mounted for rotation about a rotational axis and having an inlet opening at one axial end and an outlet opening the the other axial end;

a plurality of axially spaced apart radially outwardly extending settling compartments fast with the tubular side wall of the container about entrance apertures provided therein, each settling compartment converging from its radial inner entrance end to a closable discharge orifice at its radial outer end, the radial depth of each compartment being greater than the axial width of its entrance aperture;

valves for closing the orifices of the settling compartments;

feed means for feeding the mixture into the container through its inlet opening; and

flow means for causing the mixture to flow along the tubular side wall of the container towards its outlet end and successively towards and past the entrances to the compartments.

6. A separating and classifying apparatus as claimed in Claim 5, in which the compartments are arranged in axially spaced banks, each bank of compartments comprising a plurality of circumferentially spaced compartments.

7. A separating and classifying apparatus as claimed in Claim 5 or 6, which includes a plurality of sensors for sensing the volume of constituents settled out in some or all of the compartments, the valves of those compartments having sensors being responsive to their associated sensors to automatically open their associated discharge orifices when the volume of constituents settled out in the respective compartment exceeds a predetermined value.

8. A separating and classifying apparatus as claimed in Claim 5 or 6, which includes timing means, some or all of the valves being responsive to the timing means to automatically open their associated discharge orifices for a predetermined period of time at predetermined intervals.

9. A separating and classifying apparatus as claimed in any one of Claims 5 to 8, which includes a stationary casing disposed around the container and having means for directing the various fractions discharged from the compartments towards collecting means for separately collecting the respective fractions.

10. A separating or separating and classifying apparatus as claimed in any one of the preceding claims, in which the container is frusto-conical having its inlet opening at its narrow end and its outlet opening at its wide end.

11. A separating or separating and classifying apparatus as claimed in Claim 10, in which the container is mounted for rotation about a vertical axis with its narrow end at the bottom.

12. A separating or separating and classifying apparatus as claimed in any one of the preceding claims, in which the container has internal fins for agitating the mixture within the container.

13. A separating and classifying apparatus substantially as described in the specification with reference to the accompanying drawings.

KILBURN & STRODE,
Chartered Patent Agents,
Agents for the Applicants.

Printed for Her Majesty's Stationery Office by Burgess & Son (Abingdon), Ltd.—1977.
Published at The Patent Office, 25 Southampton Buildings, London, WC2A 1AY,
from which copies may be obtained.

1465311 COMPLETE SPECIFICATION

1 SHEET This drawing is a reproduction of the Original on a reduced scale

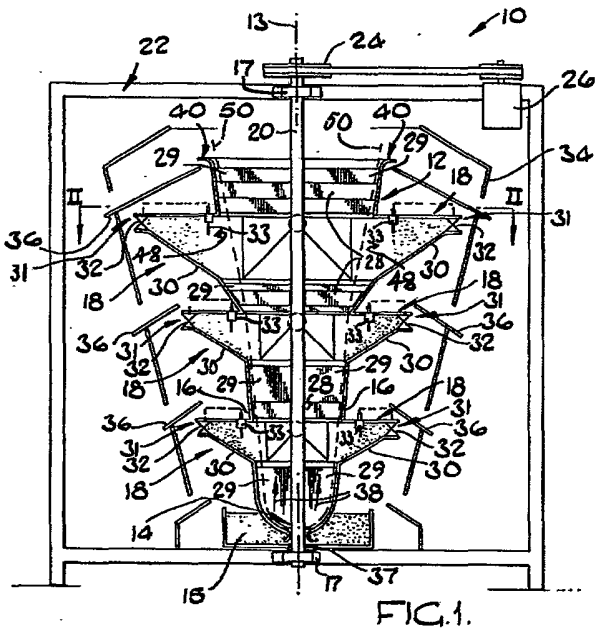

FIG.1.

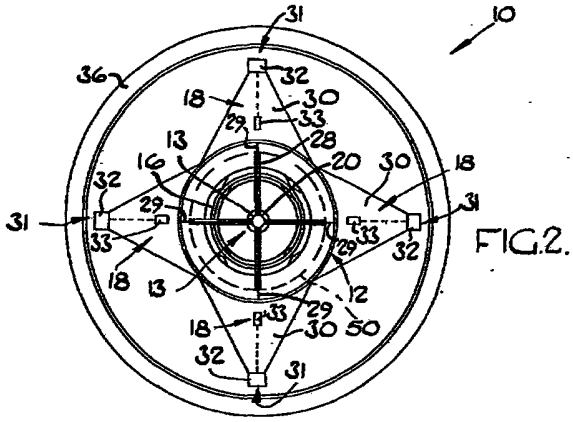

FIG.2.